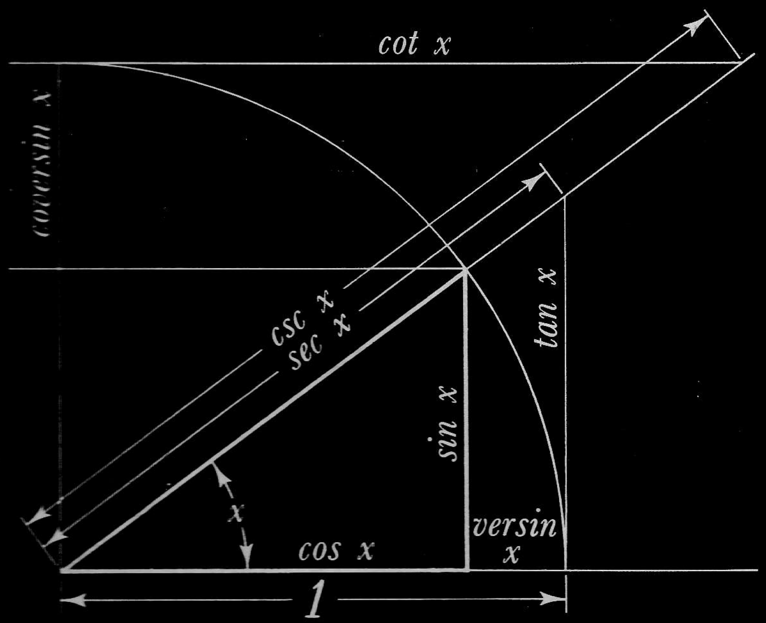
Factors and Formulas

Weights, Areas, and Volumes.



REYNOLDS
where new ideas take shape in
ALUMINUM

FOREWORD

This is a book of formulas, factors, and tables for the designer, engineer, purchasing agent, shop foreman, production manager, and executive. It contains tables of area and weight of aluminum alloy mill products, conversion factors, and a variety of useful formulas. It is intended as a reference tool that will provide easy access to the most used mathematical formulas. The information is presented in its most practical form for the greatest number of users.

The size of the book permits it to be easily stored for convenient use. The edge indexing allows ready reference to subject matter by visual tie-in with the table of contents. Formulas have been reduced to their simplest practical form.

The content of this handbook has been restricted to standard mathematical subject matter with the exception of density data and tables of gages.

Properties and specifications of aluminum alloys will be found in "Aluminum Standards and Data," published by The Aluminum Association. Structural design formulas and computations are contained in "Structural Aluminum Design," published by Reynolds Metals Company.

Comments and suggestions on the content, format, and usefulness of this handbook will be appreciated as guides for future editions.

1970
Reynolds Metals Company
Richmond, Virginia 23218

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Factors and Formulas
Weights, Areas, and Volumes

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FORMULAS

CIRCLES
COILS

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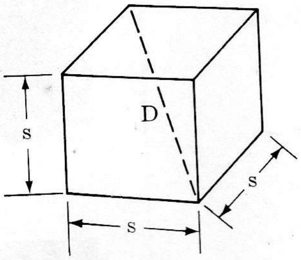
Cube

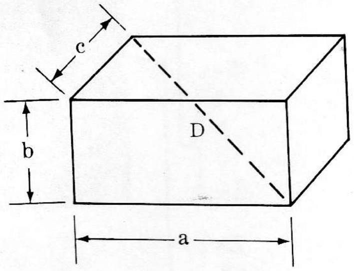


Surface Area
$A = 6s^2$

Volume
$V = s^3$

Diagonal
$D = 1.7321s$

Parallelopiped

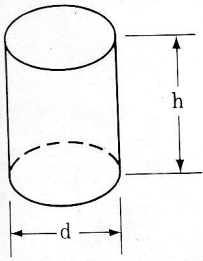


Surface Area
$A = 2(ab + bc + ac)$

Volume
$V = abc$

Diagonal
$D = \sqrt{a^2 + b^2 + c^2}$

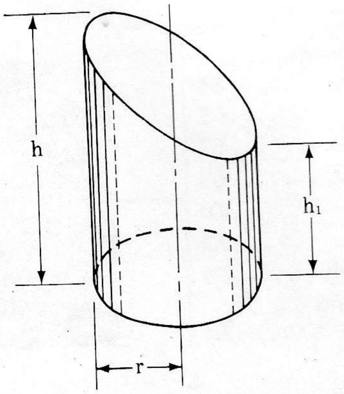
Right Circular Cylinder



Surface Area
$A = 1.5708\ d\ (2h + d)$

Volume
$V = .7854d^2h$

Frustrum of Right Circular Cylinder



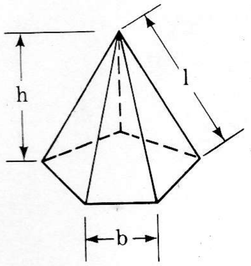
Lateral Area
$A = 3.1416\ r\ (h + h_1)$

Area of Top Section
$A = 3.1416r\sqrt{r^2 + \left(\frac{h_1 - h}{2}\right)^2}$

Area of Base
$A = 3.1416r^2$

Volume
$V = 1.5708r^2(h + h_1)$

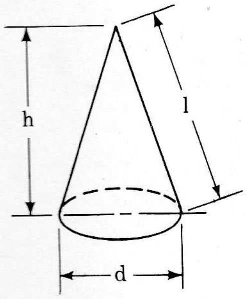
Right Regular Pyramid



Surface Area
$A = \frac{1}{2}nbl + A_B$(area of base)

Volume
$V = \frac{1}{3}A_B h$

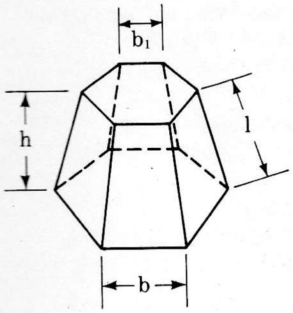
Right Regular Cone



Surface Area
$A = 1.5708d\ (.5d + l)$

Volume
$V = .2618d^2h$

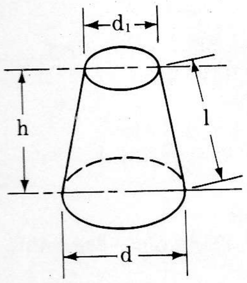
Frustrum of Right Regular Pyramid



Surface Area
$A = \frac{1}{2}\, nl(b + b_1) + A_B + A_T$

Volume
$V = \frac{1}{3}h\ (A_B + A_T + \sqrt{A_B A_T})$

Frustrum of Right Regular Cone

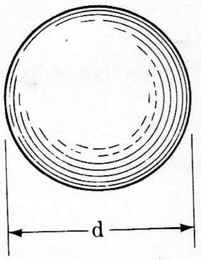


Surface Area
$A = .3927[d^2 + d^2_1 + 4l(d + d_1)]$

Volume
$V = .2618h\ (d^2 + dd_1 + d_1^2)$

FORMULAS FOR SOLIDS—*continued*

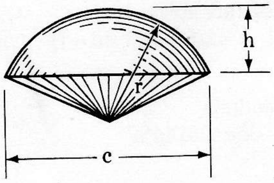
Sphere



Surface Area
$A = 3.1416d^2$

Volume
$V = .5236d^3$

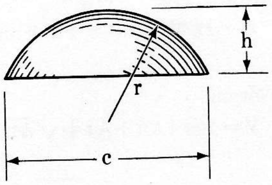
Sector of Sphere



Surface Area
$A = 1.5708\ r\ (4h + c)$

Volume
$V = 2.0944r^2h$

Segment of Sphere

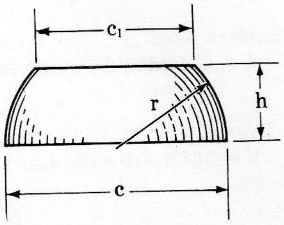


Surface Area of Top Section
$A = 6.2832rh$ or
$A = .7854\ (4h^2 + c^2)$

Total Surface Area
$A = 1.5708\ (2h^2 + c^2)$

Volume
$V = 1.0472h^2\ (3r - h)$ or
$V = .1318h\ (3c^2 + 4h^2)$

Zone of Sphere



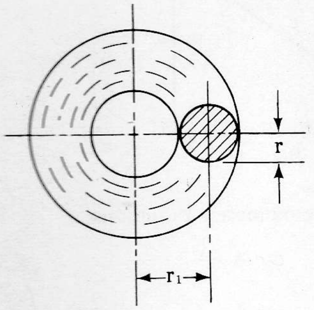
Area of Spherical Surface
$A = 6.2832rh$

Total Surface Area
$A = .7854\ (8rh + c^2 + c_1^2)$

Volume
$V = .1318h\ (3c^2 + 3c_1^2 + 4h^2)$

FORMULAS FOR SOLIDS—*concluded*

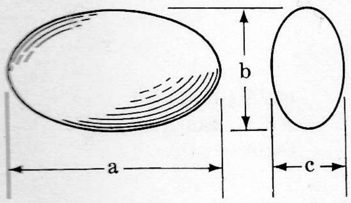
Torus



Surface Area
$A = 39.478rr_1$

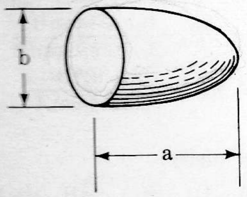
Volume
$V = 19.739r^2r_1$

Ellipsoid



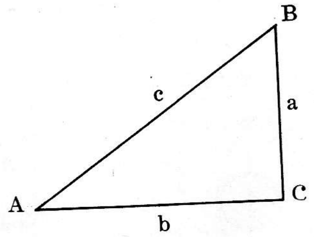
Volume
$V = .5236abc$

Paraboloid



Volume
$V = .3927ab^2$

TRIGONOMETRIC FUNCTIONS



Fundamental Trigonometric Functions

$\sin A = \frac{a}{c}$ $\quad \csc A = \frac{c}{a}$

$\cos A = \frac{b}{c}$ $\quad \sec A = \frac{c}{b}$

$\tan A = \frac{a}{b}$ $\quad \cot A = \frac{b}{a}$

Functions of one angle

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A - \tan^2 A = 1$$
$$\csc^2 A - \cot^2 A = 1$$

Functions of the sum of two angles

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$
$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$
$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$
$$\cot(A+B) = \frac{\cot A \cot B - 1}{\cot B + \cot A}$$

Functions of the difference of two angles

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$
$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$
$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$
$$\cot(A-B) = \frac{\cot A \cot B + 1}{\cot B - \cot A}$$

Functions of one-half an angle

$$\sin \tfrac{1}{2}A = \frac{\sin A}{2\cos \tfrac{1}{2}A} = \pm\sqrt{\frac{1-\cos A}{2}}$$
$$\cos \tfrac{1}{2}A = \frac{\sin A}{2\sin \tfrac{1}{2}A} = \pm\sqrt{\frac{1+\cos A}{2}}$$
$$\tan \tfrac{1}{2}A = \frac{1-\cos A}{\sin A} = \pm\sqrt{\frac{1-\cos A}{1+\cos A}}$$
$$\cot \tfrac{1}{2}A = \pm\sqrt{\frac{1+\cos A}{1-\cos A}}$$

TRIGONOMETRIC FUNCTIONS—*concluded*

Functions of twice an angle

$$\sin 2A = 2\sin A\cos A = \frac{2\tan A}{1+\tan^2 A}$$

$$\cos 2A = \cos^2 A - \sin^2 A = 1 - 2\sin^2 A$$

$$= 2\cos^2 A - 1 = \frac{1-\tan^2 A}{1+\tan^2 A}$$

$$\tan 2A = \frac{2\tan A}{1-\tan^2 A} = \frac{\sin 3A - \sin A}{\cos 3A + \cos A}$$

$$\cot 2A = \frac{\cot^2 A - 1}{2\cot A}$$

Functions of three times an angle

$$\sin 3A = 3\sin A - 4\sin^3 A$$

$$\cos 3A = 4\cos^3 A - 3\cos A$$

$$\tan 3A = \frac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$$

$$\cot 3A = \frac{\cot^3 A - 3\cot A}{3\cot^2 - 1}$$

Functions of angles squared

$$\sin^2 A = \frac{1-\cos 2A}{2}$$

$$\cos^2 A = \frac{1+\cos 2A}{2}$$

$$\tan^2 A = \frac{1-\cos 2A}{1+\cos 2A}$$

$$\cot^2 A = \frac{1+\cos 2A}{1-\cos 2A}$$

$$\sin^2 A - \sin^2 B = \sin(A+B)\sin(A-B)$$

$$\cos^2 A - \sin^2 B = \cos(A+B)\cos(A-B)$$

Functions—Relationships

$$\sin A = \frac{\cos A}{\cot A} = \frac{1}{\csc A} = \cos A\tan A = \sqrt{1-\cos^2 A}$$

$$\cos A = \frac{\sin A}{\tan A} = \frac{1}{\sec A} = \sin A\cot A = \sqrt{1-\sin^2 A}$$

$$\tan A = \frac{\sin A}{\cos A} = \frac{1}{\cot A} = \sin A\sec A$$

$$\cot A = \frac{\cos A}{\sin A} = \frac{1}{\tan A} = \cos A\csc A$$

$$\sec A = \frac{\tan A}{\sin A} = \frac{1}{\cos A}$$

$$\csc A = \frac{\cot A}{\sin A} = \frac{1}{\sin A}$$

$$\sin A + \sin B = 2\sin\tfrac{1}{2}(A+B)\cos\tfrac{1}{2}(A-B)$$

$$\sin A - \sin B = 2\cos\tfrac{1}{2}(A+B)\sin\tfrac{1}{2}(A-B)$$

$$\cos A + \cos B = 2\cos\tfrac{1}{2}(A+B)\cos\tfrac{1}{2}(A-B)$$

$$\cos A - \cos B = -2\sin\tfrac{1}{2}(A+B)\sin\tfrac{1}{2}(A-B)$$

$$\tan A + \tan B = \frac{\sin(A+B)}{\cos A\cos B}$$

$$\tan A - \tan B = \frac{\sin(A-B)}{\cos A\cos B}$$

$$\cot A + \cot B = \frac{\sin(A+B)}{\sin A\sin B}$$

$$\cot A - \cot B = \frac{\sin(B-A)}{\sin A\sin B}$$

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS

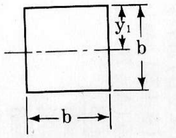
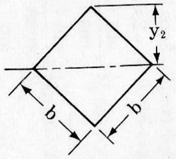
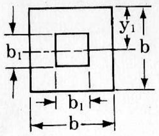
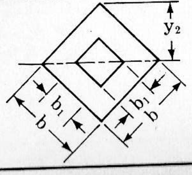
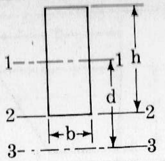
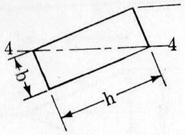
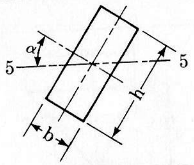
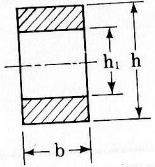
	Area A	Distance from Centroid to Extremity of Section C	Moment of Inertia I	Section Modulus $Z=I/C$	Radius of Gyration $k=\sqrt{I/A}$
	b^2	.5b	$.0833b^4$	$.167b^3$	.289b
	b^2	.7071b	$.0833b^4$	$.1178b^3$	.289b
	$b^2-b_1^2$	.5b	$.0833(b^4-b_1^4)$	$\frac{.167(b^4-b_1^4)}{b}$	$.289\sqrt{b^2+b_1^2}$
	$b^2-b_1^2$	.7071b	$.0833(b^4-b_1^4)$	$\frac{.1178(b^4-b_1^4)}{b}$	$.289\sqrt{b^2+b_1^2}$

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS (Continued)

	Area A	Distance from Centroid to Extremity of Section C	Moment of Inertia I	Section Modulus Z=I/C	Radius of Gyration $k=\sqrt{I/A}$
	bh	.5h	$(y_1)\ .0833bh^3$ $(y_2)\ .333bh^3$ $(y_3)\ bh\left(\frac{h^2}{12}+d^2\right)$	$.167bh^2$	$(y_1)\ .289h$
	bh	$\frac{bh}{\sqrt{b^2+h^2}}$	$.167\ \frac{b^3h^3}{(b^2+h^2)}$	$.167\ \frac{b^2h^2}{\sqrt{b^2+h^2}}$	$.408\ \frac{bh}{\sqrt{b^2+h^2}}$
	bh	$.5(h\cos\alpha+b\sin\alpha)$	$.0833bh\ (h^2\cos^2\alpha+b^2\sin^2\alpha)$		$.289\sqrt{h^2\cos^2\alpha+b^2\sin^2\alpha}$
	$b(h-h_1)$	.5h	$.0833\ b\ (h^3-h_1^3)$	$.167\ b\ \frac{(h^3-h_1^3)}{h}$	$.289\sqrt{\frac{h^3-h_1^3}{h-h_1}}$

[redacted]

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS (Continued)

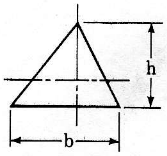
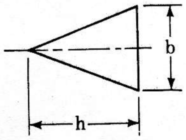
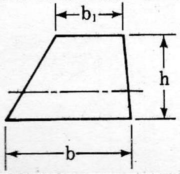
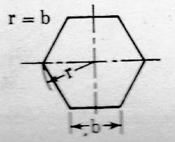
	Area A	Distance from Centroid to Extremity of Section C	Moment of Inertia I	Section Modulus $Z=I/C$	Radius of Gyration $k=\sqrt{I/A}$
	$.5bh$	$.667h$	$.0277bh^3$	$.0417bh^2$	$.236h$
	$.5bh$	$.667h$	$.02083hb^3$	$.0417hb^2$	$.204b$
	$.5h\,(b+b_1)$	$.33h\left(\frac{2b+b_1}{b+b_1}\right)$	$.0277h^3\left(\frac{b^2+4bb_1+b_1^2}{b+b_1}\right)$	$.0833h^2\left(\frac{b^2+4bb_1+b_1^2}{2b+b_1}\right)$	$\frac{.236h\sqrt{b^2+4bb_1+b_1^2}}{b+b_1}$
	$2.598b^2$	$.866b$	$.5413b^4$	$.625b^3$	$.456b$

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS (Continued)

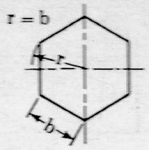
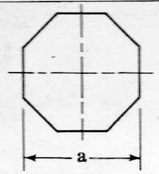
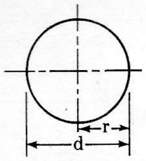
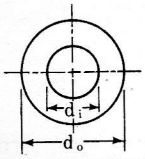
	Area A	Distance from Centroid to Extremity of Section C	Moment of Inertia I	Section Modulus $Z=I/C$	Radius of Gyration $k=\sqrt{I/A}$
	$2.598b^2$	b	$.5413b^4$	$.5413b^3$	$.456b$
	$.8284a^2$	$.5a$	$.0547a^4$	$.1095a^3$	$.257a$
	$3.1416r^2$ $.7854d^2$	r $.5d$	$.7854r^4$ $.04908d^4$	$.7854r^3$ $.09816d^3$	$.25d$
	$.7854\,(d_o^2-d_i^2)$	$.5d_o$	$.04908\,(d_o^4-d_i^4)$	$.09816\,\frac{(d_o^4-d_i^4)}{d_o}$	$.25\sqrt{d_o^2+d_i^2}$

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS (Continued)

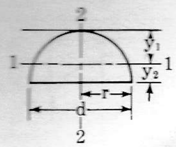
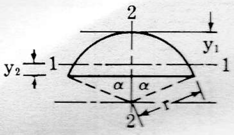
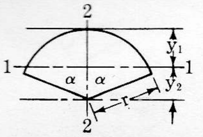
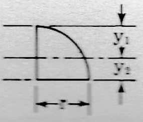
	Area A	Distance from Centroid to Extremity of Section C	Moment of Inertia I	Section Modulus Z=I/C	Radius of Gyration $k=\sqrt{I/A}$
	$1.5708r^2$	$y_1=.5756r$ $y_2=.4244r$	$I_1=.1098r^4$ $I_2=.3927r^4$	$Z_1=.1907r^3$ $Z_2=.9253r^3$	$k_1=.2643r$ $k_2=.5r$
	$.5r^2\,(2\alpha-\sin 2\alpha)$	$y_1=r\left(1-\frac{4\sin^3\alpha}{6\alpha-3\sin 2\alpha}\right)$ $y_2=r\left(\frac{4\sin^3\alpha}{6\alpha-3\sin 2\alpha}-\cos\alpha\right)$	(1)		(2)
	$r^2\alpha$	$y_1=r\left(1-\frac{2\sin\alpha}{3\alpha}\right)$ $y_2=2r\,\frac{\sin\alpha}{3\alpha}$	(3)		(4)
	$.7854r^2$	$y_1=.5756r$ $y_2=.4244r$	$.0549r^4$	$Z_1=.0954r^3$ $Z_2=.1294r^3$	$.264r$

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS (Continued)

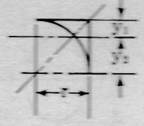
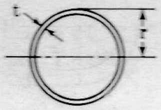
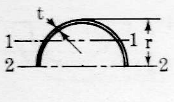
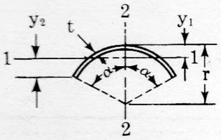
	Area A	Distance from Centroid to Extremity of Section C	Moment of Inertia I	Section Modulus Z=I/C	Radius of Gyration $k=\sqrt{I/A}$
	$.2146r^2$	$y_1=.2234r$ $y_2=.7766r$	$.0075r^4$	$Z_2=.0097r^3$	$.181r$
	$6.2832rt$	r	$3.14164r^3t$	$3.1416r^2t$	$.707r$
	$3.1416rt$	$.6366r$	$I_1=.2978r^3t$ $I_2=1.5708r^3t$	$Z_1=.4678r^2t$	$k_1=.308r$ $k_2=.707r$
	$2\alpha rt$	$y_1=r\left(1-\frac{\sin\alpha}{\alpha}\right)$ $y_2=r\left(\frac{\sin\alpha}{\alpha}-\cos\alpha\right)$	$I_1=r^3t\left(\alpha+\sin\alpha\cos\alpha-\frac{2\sin^2\alpha}{\alpha}\right)$ $I_2=r^3t\,(\alpha-\sin\alpha\cos\alpha)$		$k_1=r\sqrt{\frac{\alpha+\sin\alpha\cos\alpha-\frac{2\sin^2\alpha}{\alpha}}{2\alpha}}$ $k_2=r\sqrt{\frac{\alpha-\sin\alpha\cos\alpha}{2\alpha}}$

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS (Continued)

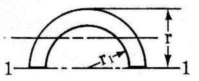
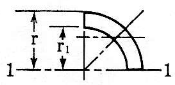
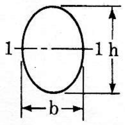
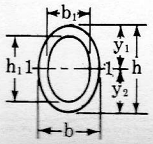
	Area A	Distance from Centroidto Extremity of Section C	Moment of Inertia I	Section Modulus $Z=I/C$	Radius of Gyration $k=\sqrt{I/A}$
	$1.5708\ (r^2-r_1^2)$	$.424\left(\frac{r^2+rr_1+r_1^2}{r+r_1}\right)$	$I_1=.3927\ (r^4-r_1^4)$		$.5\sqrt{r^2+r_1^2}$
	$.7854\ (r^2-r_1^2)$	$.424\left(\frac{r^2+rr_1+r_1^2}{r+r_1}\right)$	$I_1=.1963\ (r^4-r_1^4)$		$.5\sqrt{r^2+r_1^2}$
	$.7854bh$	$.5h$	$.0491bh^3$	$.098bh^2$	$.25h$
	$.7854\ (bh-b_1h_1)$	$.5h$	$I_1=.0491\ (bh^3-b_1h_1^3)$	$\frac{.098\ (bh^3-b_1h_1^3)}{h}$	$k_1=.25\sqrt{\frac{bh^3-b_1h_1^3}{bh-b_1h_1}}$

Table 1. PROPERTIES OF VARIOUS CROSS SECTIONS (Concluded)

(1) $I_1=r^4\left[.125\ (2\alpha-\sin 2\alpha)\left(1+\frac{2\sin^3\alpha\cos\alpha}{\alpha-\sin\alpha\cos\alpha}\right)-.88\ \frac{\sin^6\alpha}{2\alpha-\sin 2\alpha}\right]$

$I_2=r^4\left[.125\ (2\alpha-\sin 2\alpha)-.083\ \frac{(2\alpha-\sin 2\alpha)\ (\sin^3\alpha\cos\alpha)}{\alpha-\sin\alpha\cos\alpha}\right.$

(2) $k_1=.5r\sqrt{1+\frac{2\sin^3\alpha\cos\alpha}{\alpha-\sin\alpha\cos\alpha}-7.11\frac{\sin^6 3\alpha}{(2\alpha-\sin 2\alpha)^2}}$

$k_2=.5r\sqrt{1-\frac{2\sin^3\alpha\cos\alpha}{3\ (\alpha-\sin\alpha\cos\alpha)}}$

(3) $I_1=.25r^4\left(\alpha+\sin\alpha\cos\alpha-1.77\ \frac{\sin^2\alpha}{\alpha}\right)$

$I_2=.25r^4\ (\alpha-\sin\alpha\cos\alpha)$

(4) $k_1=.5r\sqrt{1+\frac{\sin\alpha\cos\alpha}{\alpha}-1.77\ \frac{\sin^2\alpha}{\alpha^2}}$

$k_2=.5r\sqrt{1-\frac{\sin\alpha\cos\alpha}{\alpha}}$

[redacted]

1. Outside Diameter of a coil.

$$d_o = \sqrt{\frac{W + .07854 d_a^2}{.07854}}$$

W = weight of one inch of coil width
d_o = outside diameter
d_a = diameter of arbor

2. Weight of each inch of coil width

$$W = .07854 \ (d_o^2 — d_a^2)$$

W = weight of each inch of coil width
d_o = outside diameter of coil
d_a = diameter of arbor

3. Weight of Rod

$$W = .94248 d^2$$

W = weight of one foot of rod (density .1 lb per cu in.)
d = diameter of rod

4. Weight of Round Tube

$$W = .9425 \ (d_o^2 — d_i^2)$$

or

$$W = 3.77t \ (d_o — t)$$

W = weight of one foot of tube (density .1 lb per cu in.)
d_o = outside diameter
d_i = inside diameter
t = wall thickness

5. Weight of Square Bar (square corners)

$$W = 1.2 s^2$$

W = weight of one foot of square bar (density .1 lb per cu in.)
s = length of one side

6. Weight of Rectangular Bar (square corners)

$$W = 1.2ab$$

W = weight of one foot of rectangular bar (density .1 lb per cu in.)
a, b = length of sides of rectangle.

7. Weight of Square Bar (round corners)

$$W = 1.2 \ (s^2 — .8584 r^2)$$

W = weight of one foot of square bar (density .1 lb per cu in.)
s = length of side (distance between flats)
r = corner radius

8. Weight of Rectangular Bar (round corners)

$$W = 1.2 \ (ab — .8584 r^2)$$

W = weight of one foot of rectangular bar (density .1 lb per cu in.)
a, b = length of sides (distances between flats)

9. Weight of Square Tube (square corners)

$$W = 4.8t \ (s — t)$$

W = weight of one foot of tube (density .1 lb per cu in.)
t = wall thickness
s = length of one side

10. Weight of Square Tube (round corners)

$$W = 4.8t \ (s — .43r — .79t)$$

W = weight of one foot of tube (density .1 lb per cu in.)
t = wall thickness
s = length of a side
r = radius of corners (outside)

11. Weight of Rectangular Tube (square corners)

$$W = 2.4t \ (a + b — 2t)$$

W = weight of one foot of tube (density .1 lb per cu in.)
a,b = length of sides
t = wall thickness

12. Weight of Rectangular Tube (round corners)

$$W = 2.4t \ (a + b — .8584r — 1.5708t)$$

W = weight of 1 foot of tube (density .1 lb per cu in.)
a,b = length and width, overall
r = radius of corner
t = wall thickness

13. Weight of Hexagonal Rod

$$W = 1.039 D^2$$

W = weight of one foot of rod (density .1 lb per cu in.)
D = distance across flats

14. Weight of Hexagonal Tube

$$W = 4.156t \ (D — t)$$

W = weight of one foot of tube (density .1 lb per cu in.)
D = distance across flats
t = wall thickness

Table 2. CIRCLES — AREAS

DIAMETER FRACTION (In.)	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
DIAMETER WHOLE NO. (Inches)	**AREA — Square Feet**															
1	.0055	.0062	.0069	.0077	.0085	.0094	.0103	.0113	.0123	.0133	.0144	.0155	.0167	.0179	.0192	.0205
2	.0218	.0232	.0246	.0261	.0276	.0292	.0308	.0324	.0341	.0358	.0376	.0394	.0412	.0431	.0451	.0471
3	.0491	.0512	.0533	.0554	.0576	.0598	.0621	.0644	.0668	.0692	.0717	.0742	.0767	.0793	.0819	.0846
4	.0873	.0900	.0928	.0956	.0985	.1014	.1044	.1074	.1104	.1135	.1167	.1198	.1231	.1263	.1296	.1330
5	.1364	.1398	.1433	.1468	.1503	.1539	.1576	.1613	.1650	.1688	.1726	.1764	.1803	.1843	.1883	.1923
6	.1963	.2005	.2046	.2088	.2131	.2173	.2217	.2260	.2304	.2349	.2394	.2439	.2485	.2531	.2578	.2625
7	.2673	.2720	.2769	.2818	.2867	.2916	.2967	.3017	.3068	.3119	.3171	.3223	.3276	.3329	.3382	.3436
8	.3491	.3545	.3600	.3656	.3712	.3768	.3826	.3883	.3941	.3998	.4057	.4116	.4176	.4236	.4296	.4357
9	.4418	.4479	.4541	.4604	.4667	.4730	.4794	.4858	.4922	.4987	.5052	.5118	.5185	.5251	.5319	.5386
10	.5454	.5523	.5591	.5660	.5730	.5800	.5871	.5942	.6013	.6085	.6158	.6230	.6303	.6377	.6450	.6525
11	.6600	.6675	.6751	.6827	.6903	.6980	.7057	.7135	.7213	.7292	.7371	.7450	.7530	.7611	.7691	.7772
12	.7854	.7933	.8019	.8103	.8185	.8270	.8357	.8435	.8522	.8608	.8694	.8781	.8867	.8954	.9040	.9126
13	.9217	.9307	.9393	.9488	.9576	.9668	.9755	.9849	.9940	1.003	1.012	1.022	1.031	1.041	1.050	1.060
14	1.069	1.078	1.089	1.098	1.108	1.118	1.127	1.137	1.147	1.157	1.166	1.177	1.187	1.197	1.207	1.217
15	1.227	1.237	1.248	1.258	1.268	1.279	1.290	1.300	1.310	1.321	1.331	1.342	1.353	1.363	1.374	1.385
16	1.396	1.407	1.418	1.429	1.440	1.451	1.462	1.473	1.485	1.496	1.507	1.519	1.530	1.542	1.552	1.565
17	1.576	1.588	1.598	1.612	1.623	1.634	1.646	1.659	1.670	1.682	1.694	1.707	1.718	1.730	1.743	1.755
18	1.767	1.780	1.791	1.804	1.817	1.829	1.842	1.854	1.867	1.879	1.892	1.905	1.918	1.931	1.943	1.956
19	1.969	1.982	1.995	2.008	2.021	2.034	2.048	2.061	2.074	2.088	2.101	2.114	2.127	2.141	2.154	2.168
20	2.182	2.195	2.209	2.223	2.237	2.250	2.264	2.278	2.292	2.306	2.320	2.334	2.348	2.362	2.377	2.391

Table 2. CIRCLES — AREAS (Continued)

DIAMETER FRACTION (In.)	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
DIAMETER WHOLE NO. (Inches)	**AREA — Square Feet**															
21	2.405	2.420	2.434	2.448	2.463	2.477	2.492	2.506	2.521	2.536	2.551	2.565	2.580	2.595	2.610	2.625
22	2.640	2.655	2.670	2.685	2.700	2.716	2.730	2.746	2.761	2.777	2.792	2.807	2.823	2.838	2.854	2.869
23	2.885	2.900	2.917	2.932	2.948	2.964	2.980	2.996	3.012	3.028	3.044	3.060	3.076	3.093	3.109	3.125
24	3.142	3.158	3.174	3.191	3.207	3.224	3.241	3.257	3.274	3.290	3.307	3.324	3.341	3.358	3.375	3.392
25	3.409	3.426	3.443	3.460	3.477	3.495	3.512	3.529	3.547	3.564	3.581	3.599	3.616	3.634	3.651	3.669
26	3.687	3.705	3.734	3.740	3.758	3.776	3.794	3.812	3.830	3.848	3.867	3.885	3.903	3.921	3.939	3.958
27	3.976	3.994	4.013	4.031	4.050	4.069	4.087	4.106	4.125	4.143	4.162	4.181	4.200	4.219	4.238	4.257
28	4.276	4.295	4.314	4.334	4.353	4.372	4.391	4.411	4.430	4.450	4.469	4.489	4.808	4.528	4.547	4.567
29	4.587	4.606	4.627	4.646	4.666	4.687	4.706	4.727	4.746	4.767	4.787	4.807	4.827	4.848	4.868	4.888
30	4.909	4.927	4.950	4.970	4.991	5.011	5.032	5.053	5.074	5.094	5.115	5.136	5.157	5.179	5.199	5.221
31	5.241	5.263	5.284	5.305	5.326	5.348	5.369	5.390	5.412	5.433	5.455	5.476	5.498	5.520	5.541	5.563
32	5.585	5.607	5.629	5.650	5.673	5.695	5.717	5.739	5.761	5.783	5.806	5.828	5.850	5.872	5.895	5.917
33	5.940	5.962	5.985	6.007	6.030	6.052	6.075	6.098	6.121	6.143	6.167	6.189	6.213	6.236	6.259	6.282
34	6.305	6.328	6.351	6.375	6.398	6.422	6.444	6.468	6.492	6.515	6.539	6.562	6.586	6.610	6.633	6.657
35	6.681	6.705	6.729	6.753	6.777	6.802	6.825	6.850	6.874	6.898	6.922	6.947	6.971	6.995	7.020	7.044
36	7.069	7.093	7.118	7.142	7.167	7.192	7.216	7.241	7.266	7.291	7.316	7.341	7.366	7.392	7.416	7.442
37	7.467	7.492	7.517	7.543	7.568	7.594	7.619	7.644	7.670	7.695	7.721	7.747	7.772	7.798	7.824	7.850
38	7.876	7.901	7.928	7.953	7.980	8.006	8.032	8.059	8.085	8.111	8.137	8.164	8.190	8.216	8.243	8.269
39	8.296	8.322	8.349	8.376	8.403	8.429	8.456	8.483	8.510	8.536	8.564	8.590	8.618	8.646	8.672	8.700
40	8.726	8.754	8.781	8.809	8.836	8.864	8.891	8.919	8.946	8.974	9.001	9.029	9.057	9.085	9.112	9.140

Table 2. CIRCLES — AREAS (Continued)

DIAMETER FRACTION (In.)	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
DIAMETER WHOLE NO. (Inches)	AREA — Square Feet															
41	9.169	9.196	9.225	9.252	9.281	9.309	9.337	9.366	9.394	9.422	9.450	9.479	9.507	9.536	9.564	9.593
42	9.621	9.650	9.678	9.707	9.736	9.765	9.793	9.822	9.851	9.880	9.910	9.938	9.968	9.998	10.03	10.06
43	10.08	10.11	10.14	10.17	10.20	10.23	10.26	10.29	10.32	10.35	10.38	10.41	10.44	10.47	10.50	10.53
44	10.56	10.59	10.62	10.65	10.68	10.71	10.74	10.77	10.80	10.83	10.86	10.89	10.92	10.95	10.98	11.01
45	11.04	11.08	11.11	11.14	11.17	11.20	11.23	11.26	11.29	11.32	11.35	11.38	11.42	11.45	11.48	11.51
46	11.54	11.57	11.60	11.64	11.67	11.70	11.73	11.76	11.79	11.82	11.86	11.89	11.92	11.95	11.98	12.02
47	12.05	12.08	12.11	12.14	12.18	12.21	12.24	12.27	12.31	12.34	12.37	12.40	12.44	12.47	12.50	12.53
48	12.57	12.60	12.63	12.66	12.70	12.73	12.76	12.80	12.83	12.86	12.90	12.93	12.96	13.00	13.03	13.06
49	13.10	13.13	13.16	13.20	13.23	13.26	13.30	13.33	13.36	13.40	13.43	13.46	13.50	13.53	13.57	13.60
50	13.64	13.67	13.70	13.74	13.77	13.81	13.84	13.88	13.91	13.94	13.98	14.01	14.05	14.08	14.12	14.15
51	14.19	14.22	14.26	14.29	14.33	14.36	14.40	14.43	14.47	14.50	14.54	14.57	14.61	14.64	14.68	14.71
52	14.75	14.78	14.82	14.86	14.89	14.93	14.96	15.00	15.03	15.07	15.10	15.14	15.18	15.21	15.25	15.28
53	15.32	15.36	15.39	15.43	15.47	15.50	15.54	15.58	15.61	15.65	15.68	15.72	15.76	15.79	15.83	15.87
54	15.90	15.94	15.98	16.02	16.05	16.09	16.13	16.16	16.20	16.24	16.28	16.31	16.35	16.39	16.42	16.46
55	16.50	16.54	16.57	16.61	16.65	16.69	16.72	16.76	16.80	16.84	16.88	16.91	16.95	16.99	17.03	17.07
56	17.10	17.14	17.18	17.22	17.26	17.30	17.33	17.37	17.41	17.45	17.49	17.53	17.57	17.60	17.64	17.68
57	17.72	17.76	17.80	17.84	17.88	17.92	17.95	17.99	18.03	18.07	18.11	18.15	18.19	18.23	18.27	18.31
58	18.35	18.39	18.43	18.47	18.51	18.55	18.59	18.63	18.67	18.70	18.74	18.78	18.83	18.86	18.90	18.94
59	18.99	19.03	19.07	19.11	19.15	19.19	19.23	19.27	19.31	19.35	19.39	19.43	19.47	19.51	19.55	19.59
60	19.63	19.68	19.72	19.76	19.80	19.84	19.88	19.93	19.96	20.00	20.05	20.09	20.13	20.17	20.21	20.25